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TCS-1454-63-KH

Copy No. 3

1401 SYSTEM

Present Status and Future of the IBM 1401 SystemI Problem

To determine the status of the IBM 1401 system and its utilization and future demands on this equipment within the Center.

II Facts Bearing on the ProblemA. Background

1. Beginning in January 1957, NPIC developed a punched card system for the production of immediate photo interpretation reports (IPIR, OAK, SITSUM and MCI, hereafter called IPIRs and MCIs) and background Target Briefs utilizing the IBM 407 Tabulating Machine's 150-lines per minute printing capability. This system provided for individual target readouts to be punched as read, sorted into any desired sequence, listed on reproduceable offset masters for hard copy reproduction and converted to punched paper tape for electrical transmission. Corrections, insertions and deletions could be made easily up to the time of printing. The readouts were then used to update the Target Brief file. (See Figure 1.)

2. With the advent of satellite reconnaissance, which covers 3-5 million square miles and 2-3,000 targets in one mission, the IBM 407 could not handle the printing demands. Installation of an IBM 1401 system (8K, 4 slow-speed tape drives) was approved in mid-1961 to obtain the better and faster printing capability of the 600 lines-per-minute 1403 printer. Training of programmers, systems design, and programming began in January 1962. The system was delivered and became operational on 16 July 1962.

B. Present Status of the 1401 System

1. The utilization of the 1401 system since delivery has grown rapidly, averaging 230 hours per month during the first Quarter of 1963. (See Figure 2.) The growth in utilization has been due primarily to daily Cuban overflights and to TALENT missions on China, Tibet and SE Asia. It should be noted that there was no successful KH mission from mid-December 1962 to April 1963.

2. An appreciation of the applications on the 1401 may be obtained from Attachment 1, which lists all operational programs and the frequency of their use. Machine utilization divides into the following primary applications. (See Figure 3.)

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a. The Immediate Reporting Cycle accounts for 80% of total 1401 utilization and involves four sets of programs:

- 1) Those which produce proofs and offset reproduction masters for IPIR's. (An average of 225 targets is processed for each IPIR.)
- 2) Those which produce partial and final MCI proofs, final MCI reports, and magnetic tape output to update the Target Briefs and MCI master tape files. (Each KH MCI includes readouts on 1,200-2,000 targets selected from some 2,000-3,000 targets reviewed by the PI.)
- 3) Those which are used to update and/or list the target briefs file (containing approximately 12,000 targets) and prepare indexes as required.
- 4) Those designed to select various portions of the target brief files as required.

b. "All Source"/Minicard applications account for 5% of total 1401 utilization. This category includes publication of the "All Source" listings which index more than 16,000 photo interpretation and photo related reports; retrieval of specific bibliographies in response to analyst requests; library circulation control over approximately 10,000 codeword documents; and edit/ control programs which produce error check listings and control listings for Minicard input. Approximately 300 documents are accessioned per month.

c. Support of other NPIC components accounts for 3% of 1401 utilization. Included are the generation and listing for publication of acquisition numbers which are assigned to downgraded photography; the editing of original ephemeris data and printing of the "Best Guess" and final ephemeris reports; cumulative monthly listings of regular and overtime hours worked on projects by NPIC personnel; monthly NPIC project status and contract status reports.

d. Preparatory and utility operations, which include assemblies, testing operations, sorting operations, etc., account for 12% of the 1401 utilization.

### C. Future Demands Upon the System

#### 1. Expansion of NPIC

a. According to current plans, PI strength at NPIC will expand substantially during FY-64. The effective increase in PI strength will be even greater, moreover, since the consolidation

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of Army, Navy and Air Force detachments into a DIA element will permit PI teams to be cut from four to three and possibly two members.

b. It is estimated that there will be a threefold increase in satellite missions in FY-64. The resolution of imagery received is expected to increase to the point where detailed interpretation of target facilities similar to that accomplished by TALENT material will be possible. As a result, requirements for PI readout and for collateral information to support the PI will increase very rapidly and substantially.

c. Film inputs from U-2 photography are expected to remain at the current high level. Moreover, pressure to extend coverage mounts daily. Excluding Cuba, it is estimated there will be 35 missions flown as compared with 20 flown to date in FY-63.

## 2. Implication for Operation of Present System

We conservatively estimate that the conclusion of the present calendar year will witness no less than a 70% growth in size and a 100% increase in activity directed against the data base in the 1401 system. Applying these factors to operations during the four month period October 1962 thru January 1963, it is estimated that utilization will reach 590 hours per month by the end of 1963 (Figure 4).

## III Discussion

### A. System Problems and Equipment Requirements

1. To keep pace with the increasing volume and tempo of NPIC intelligence production, it is imperative that certain limitations of the present 1401 system be eliminated. Production of IPIR's and MCIs will be constantly overlapping each other. Each readout should be added to the data base as soon as feasible. Each new listing of target briefs will have to reflect all available data whether it be from a completed report or from an initial proof of a report still in the production cycle.

2. With the present system, entire files must be passed through the computer memory whenever it is desired to update Target Briefs. Because of the extensive run time (12 hours for the main Target Brief file), updating additions and corrections must be batched extensively. An on-line immediate access

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storage capability, allowing the file to be updated by processing only the portions to be changed would alleviate this problem.

3. The Target Brief file cannot be updated if it interferes with the proof listing or mat-generation of an IPIR. The core storage of the 1401 system is insufficient to permit incorporation of interrupt and restart routines and an immediate report must be processed as soon as it becomes available. Since we have been averaging two to three IPIR's daily, seven days a week since October, this presents a considerable scheduling problem. The ability to interrupt lengthy operations to handle urgent priority demands is now required. Resumption of the interrupted operation at or near the point of departure is also a requirement.

4. Multiple runs are required to accomplish one maintenance operation involving both updating from immediate reports and corrections. The restriction is primarily due to limited computer memory space for instructions to perform more complex operations and the necessity to maintain like sequences between the updating information and the file being updated. Additional memory and random access storage would permit consolidation of runs.

5. Because of limited core capacity, present programs are necessarily sophisticated, difficult to write, and time consuming to modify. Additional core would permit straight-forward, modular programming, facilitating check out and modification.

6. Retrieval operations are unnecessarily time consuming. Retrieval speed should be augmented by faster data transfer rates and by use of random access storage.

7. The present system is limited in the various sequences in which large files can be arranged, due to the time consumed by magnetic tape sorting of the entire file. This means, for example, that it is not feasible to list target briefs in pass sequence. With immediate access storage, however, only a relatively small index to the files need be sorted.

8. The present system is overwhelmed with the enormous printing load. This can be alleviated by overlapping input, output and processing operations and by faster printer speeds.

- 4 -

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**B. Additional Requirements**

There are a number of additional applications for machine processing identified at the present time and many more will develop as the activities and staff of NPIC expand and diversify. They point to the need for greater system throughput capability and flexibility. Additional requirements include:

1. The purging of target brief files to prevent them from becoming too bulky for efficient use by the photo interpreter.
2. Maintenance of a Report File to satisfy the increasing number of requests for listings of published IPIRs and MCIs cumulated by installation and sorted in various sequences. The total collection of these reports can no longer be contained in the Target Briefs file.
3. The Operations Staff is developing a detailed management information system to provide daily information on the status of work in progress and to provide a base for projection of future requirements. Machine support is required.
4. A program is needed to prepare clear text bibliographies of reports pertinent to specific requests of the Minicard system, so that requesters may select the documents they wish duplicated.
5. A comprehensive program is required for supplying or exchanging portions or all of the various files of interest to each of the major commands, agencies, centers or services.

**C. Conversion to the UNIVAC 490**

1. Theoretically it would be possible to convert the present and anticipated 1401 applications to the 490. It has been decided, however, that such conversion is not feasible at the present time because of the delays such transfer would incur in the implementation of the real time mensuration system.
2. Furthermore, major activities of both systems peak concurrently necessitating very detailed consideration of the possibilities for overlap. Neither 490 programmers conversant with CSD applications nor the time to train programmers and write, assemble, and test programs are available. To train programmers and reprogram would involve at least a year's time; the present 1401 system cannot keep up with the anticipated workload during

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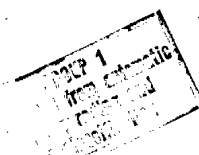
this period. See the attached staff study "Present Status and Future of the UNIVAC 490 System."

#### D. Equipment Recommendations

1. A careful review of present and anticipated NPIC workloads and requirements has been made jointly with IBM. As a result, we recommend as a minimum that the present 1401 system (monthly rental \$6,630.00) be replaced by the equipment listed below as quickly as possible. The 1401 system will be phased out after acceptance and full conversion to the new system.

<u>Qty</u>	<u>Type</u>	<u>Model/Feature</u>	<u>Description</u>	<u>Mo. Rental</u>
1	1411	3	Processing Unit	\$ 5,400
1		3470	Dual Synchronizer	325
1		5620	Priority	125
1		5730	Processing Overlap	200
1		3302	Disk Storage Adapter	65
1		4659	I/O Adapter	25
1		7823	Tape I/O Adapter	55
1		7824	Tape I/O Adapter	55
1	1415	1	Console	250
1	1414	3	I/O Synchronizer	675
1		7680	Synchronizer Storage	550
1		7681	Synchronizer Storage	60
2	1414	1	I/O Synchronizer	1,950
1		3585	800 cpi Feature	35
1		3586	800 cpi Feature	35
1	1402	2	Card Read Punch	615
1	1403	2	Printer	775
4	729	5	Magnetic Tape Units	3,000
1	7631	1	File Control	835
1	1301	2	Disk Storage	3,500
<b>TOTAL</b>				<b>\$18,530</b>

2. Further, we recommend that the 1403 model 2 printer (600 lines/min) and 7680 and 7681 synchronizer storage be replaced by a 1403 model 3 printer (1100 lines/min) with the necessary 7682 synchronizer storage as soon as they become available (scheduled for mid 1964). The additional cost will be \$875.00 per month. Three character changes will be required in each printer.

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3. The recommended disk system best satisfies the equipment requirements identified in sections A & B above, provides program compatibility with the existing 1401 system, and will permit us to utilize the experience and training of the present 1401 programming staff. (See Figure 5). The effect on estimated utilization is shown in Figure 6.

#### IV. Conclusions

1. The existing 1401 system will not continue to satisfy NFIC data processing requirements.

2. Conversion of 1401 applications to the 490 is not now feasible.

3. As a minimum, a 1410 disk system is needed.

#### V. Recommendation and Action

It is recommended that we proceed with the installation of the 1410 disk system specified in Section D.1 above as rapidly as feasible. A memorandum requesting the Office of Logistics to issue a "letter of intent" to IBM is attached for your signature.

  
Chief, Collateral Support Division  
NFIC

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- 7 -  
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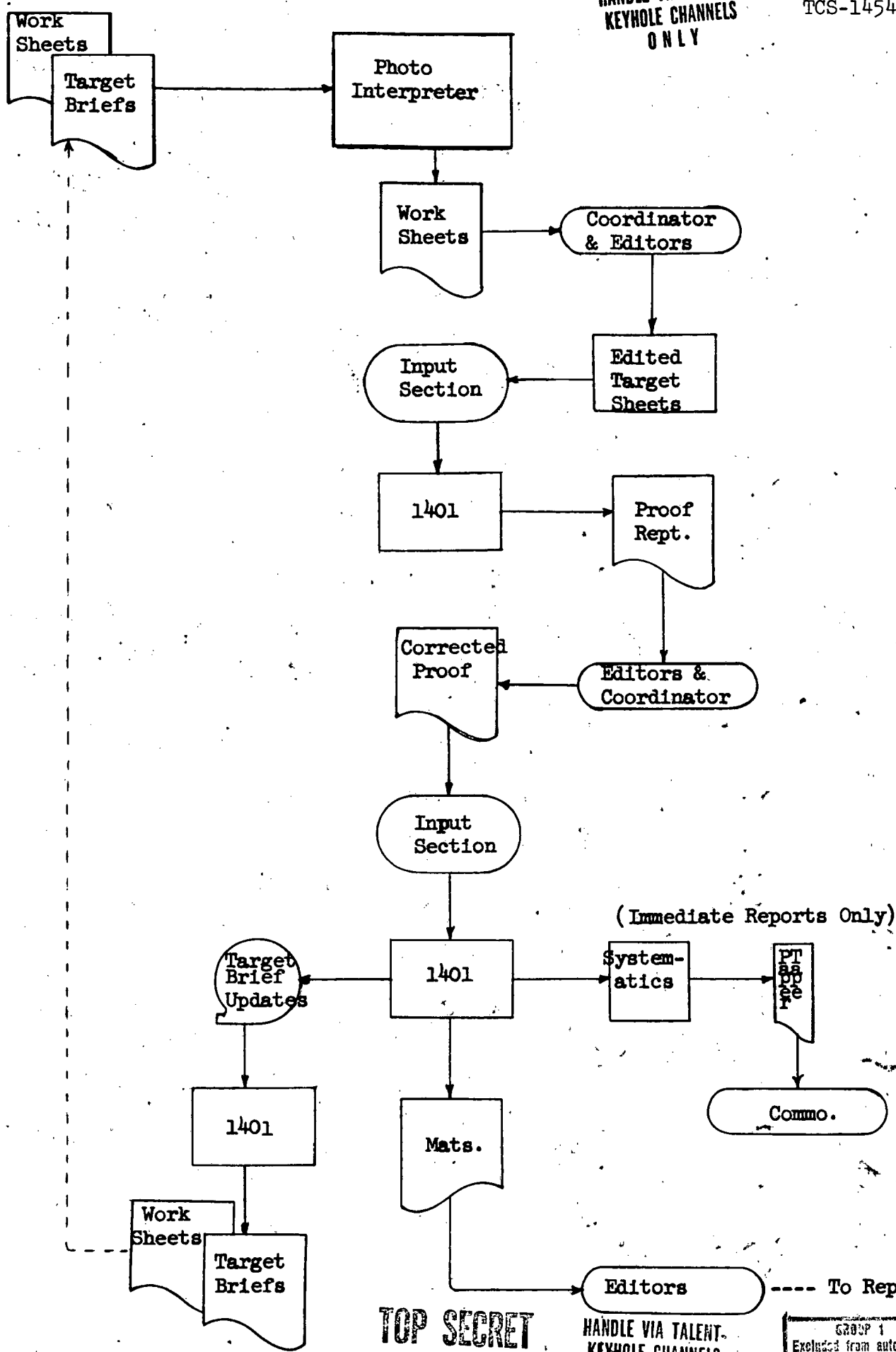
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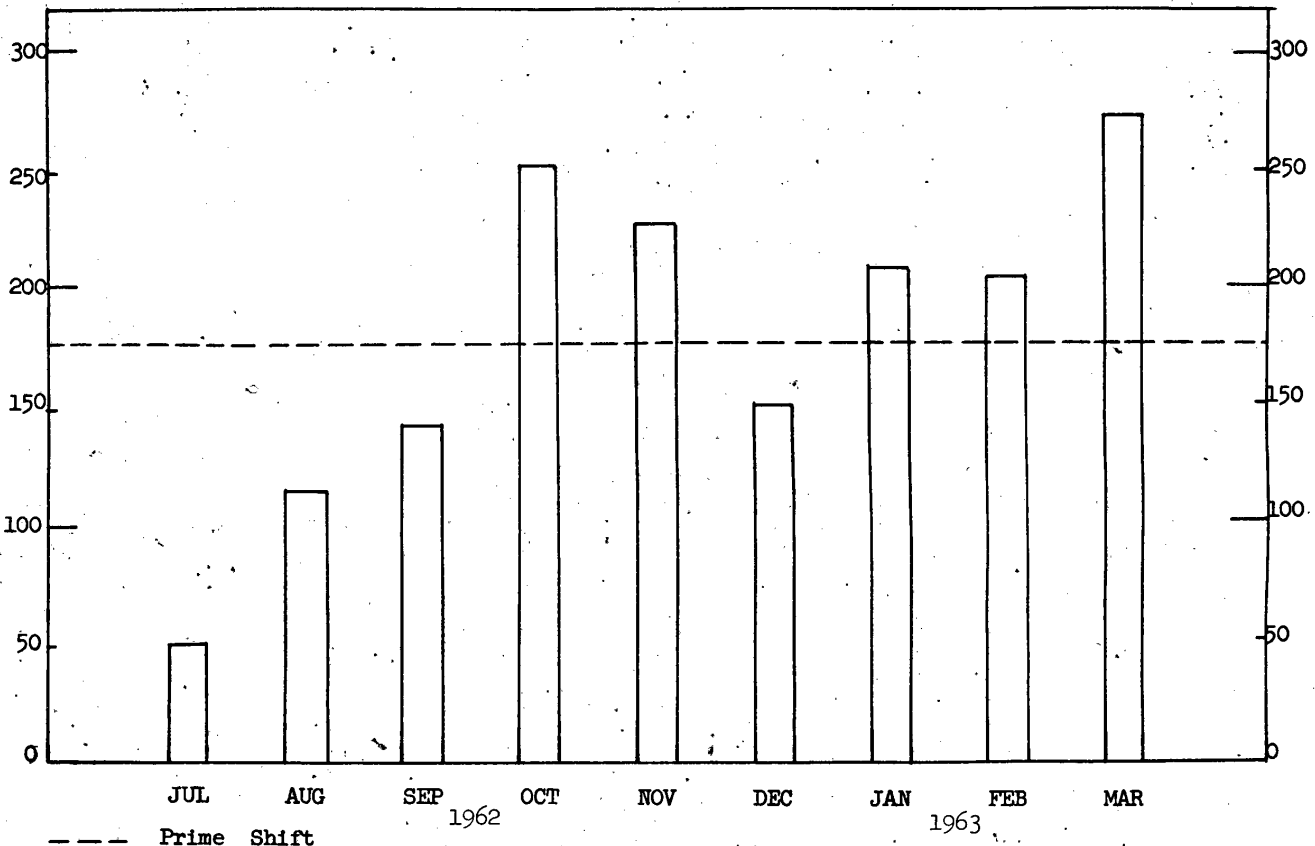
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MONTHLY UTILIZATION  
OF 1401 DATA PROCESSING SYSTEM  
(Excludes Set-up Time)

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Figure 3

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1401 Utilization

Distributed According to Primary Applications

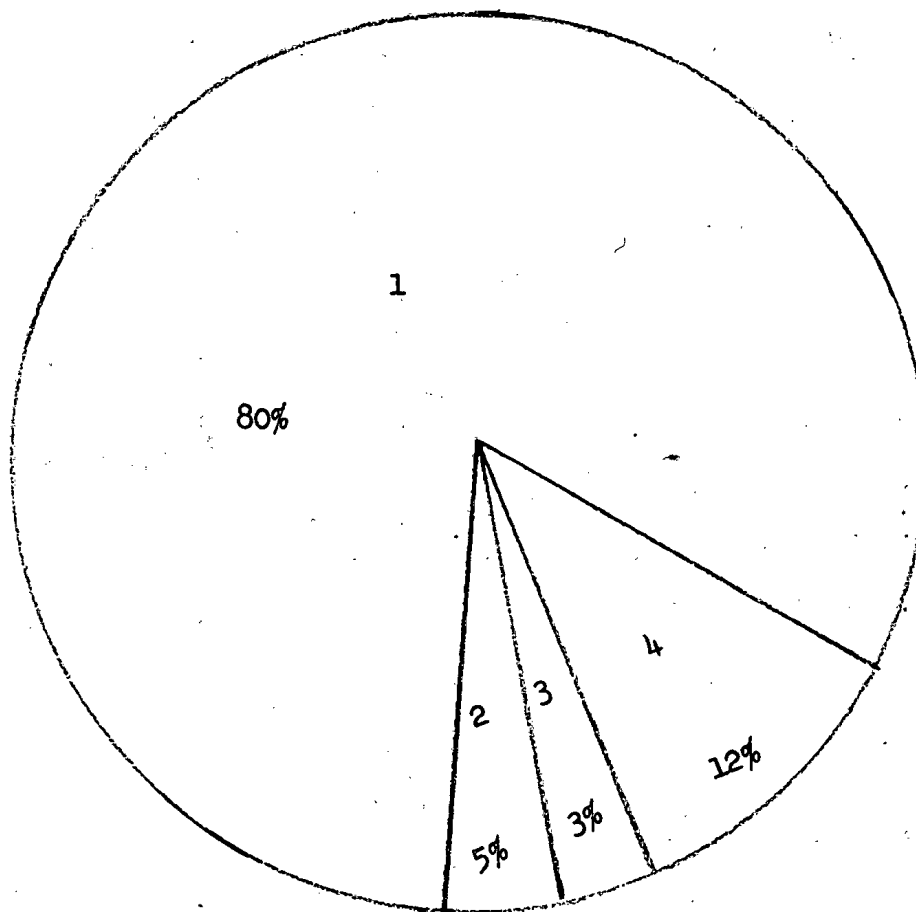


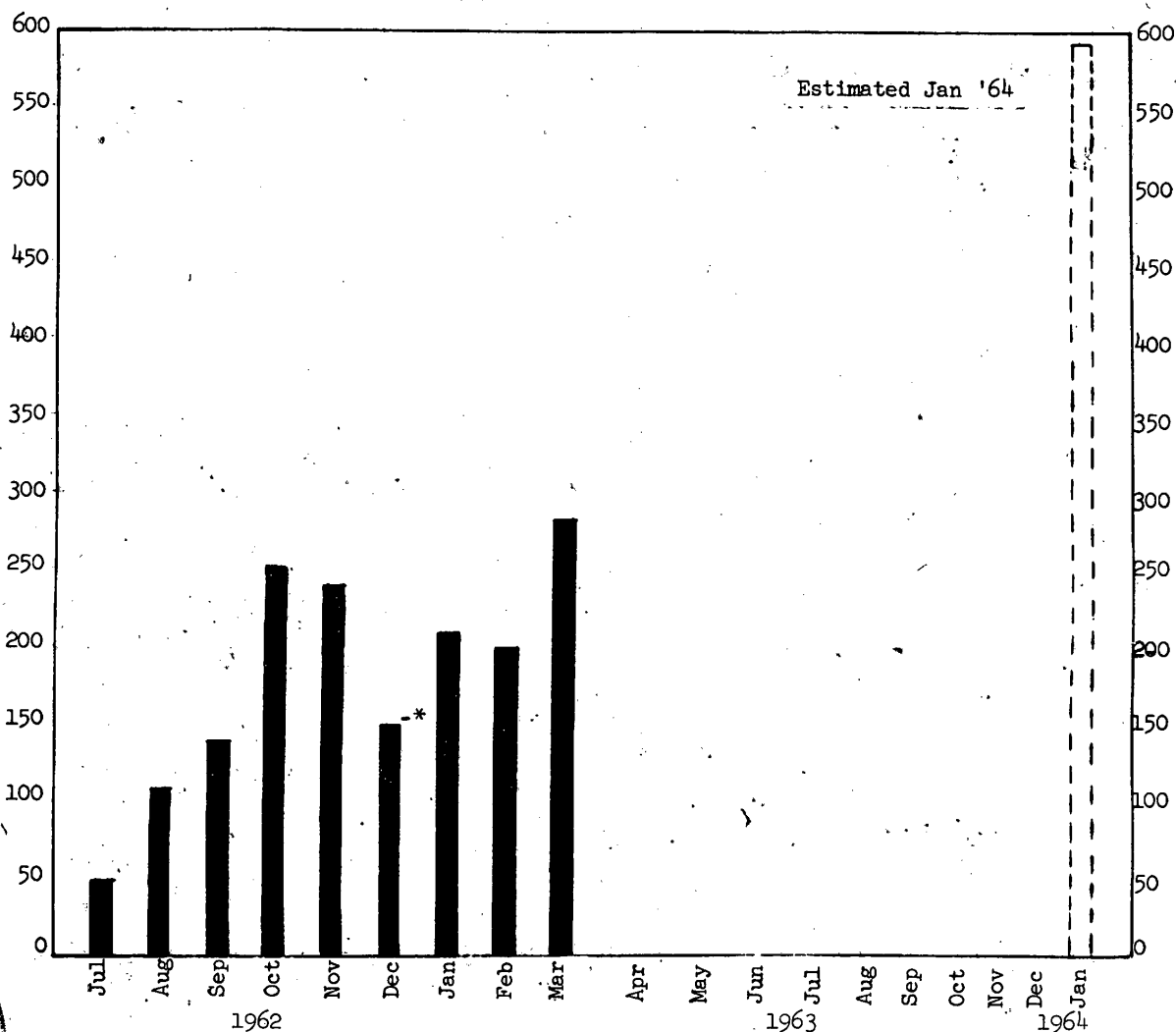
Chart Key

- 1 = Immediate Reporting Cycle
- 2 = All Source/Minicard Application
- 3 = Support of other NPIC Components
- 4 = Preparatory and Utility Operations

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MONTHLY UTILIZATION OF 1401 DATA PROCESSING SYSTEM

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Comparative Analysis of System Configurations ConsideredRequired CapabilitiesConfiguration Considered

expressed as a function of computer system's hardware.

	Present 1401	Expanded 1401	Dual 1401's	1460	1410 Tape	1410 Disk		
Printing Speed	600	600	600	1100	1100	1100		
Internal Speed	11.5	11.5	11.5	6	4.5	4.5		
Memory Capacity	8	16	8	16	20	40		
Large Volume, On-Line Data Storage	No	No	No	No	No	Yes		
Direct Access to Records	No	No	No	No	No	Yes		
Priority Interrupt	No	No	No	No	Yes	Yes		
Processing-Input/Output Overlap	No	No	No	No	Yes	Yes		
Variety of Access Equipments Possible	No	No	No	No	Yes	Yes		

Chart Key

Print speeds shown are rated maximum, in lines-per-minute, for the fastest model of printers which can be attached to the system.

Internal speeds are expressed in microseconds per core access.

Memory capacity figures indicate the recommended core sizes, expressed in thousands of addressable core locations, for each system configuration.

Yes indicates the presence of a hardware capability or capacity on the system, No its absence.

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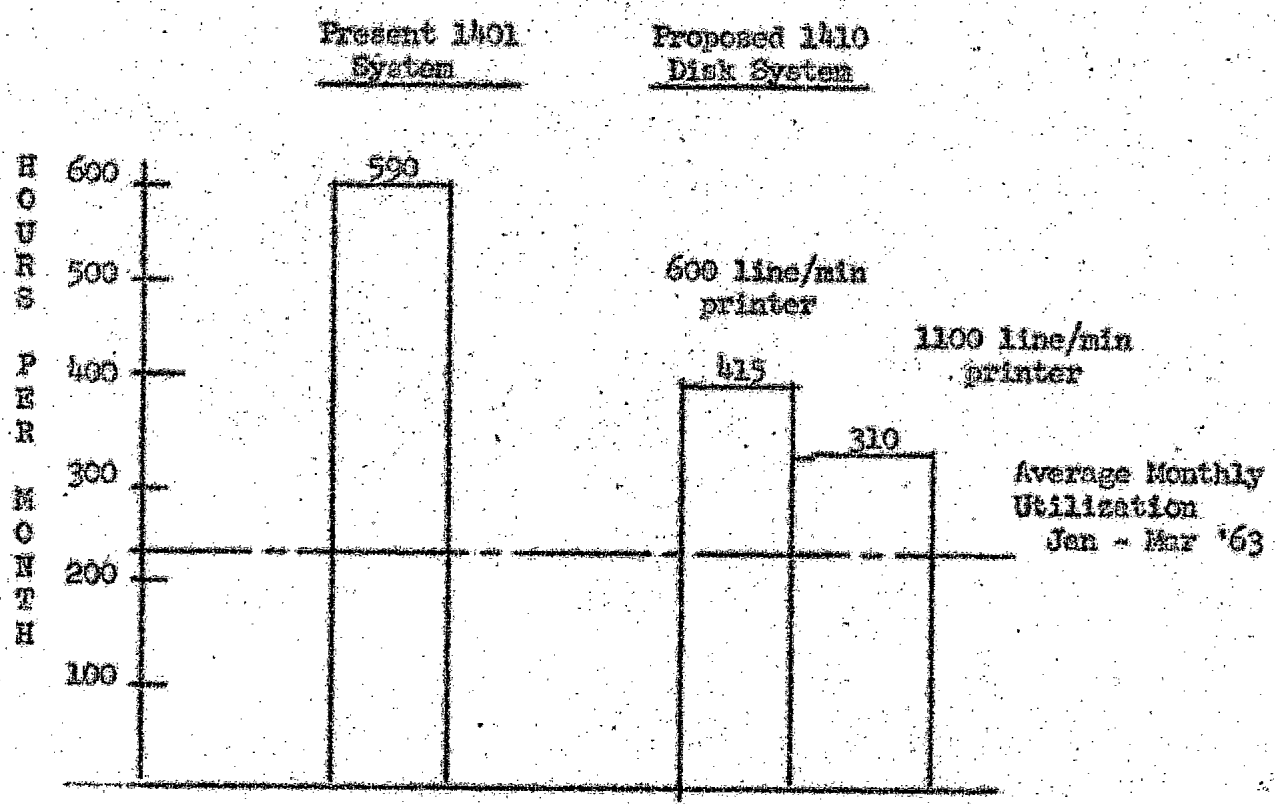
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Figure 6  
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Estimated Utilization of the Present  
and Recommended Computer Systems  
by January 1964



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